RECORD OF DECISION
FOR
GROUND WATER REMEDIATION

NAVAL INDUSTRIAL RESERVE ORDNANCE PLANT
FRIDLEY, MINNESOTA

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DECLARATION

SITE NAME AND LOCATION

Naval Industrial Reserve Ordnance Plant
Fridley, Minnesota

STATEMENT OF BASIS AND PURPOSE

This decision document presents a selected remedial action which will provide hydraulic containment and recovery of ground water (operable unit) at the Naval Industrial Reserve Ordnance Plant (NIROP) site in Fridley, Minnesota. This decision document was developed in accordance with CERCLA, as amended by SARA, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Through this document, the Navy plans to remedy the threat to human health, welfare, or the environment posed by VOC-contaminated ground water by hydraulic containment, recovery, and treatment. This decision document is based on the administrative record for this site.

The Minnesota Pollution Control Agency (MPCA) and United States Environmental Protection Agency (USEPA) concur with the selected remedy.

On-going work at the NIROP is defining the extent of soils contamination. A subsequent Record of Decision (ROD) may be issued in the future for a soils operable unit.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the NIROP, if not addressed by implementing the response action selected in this Record of Decision, may present a threat to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

This action addresses the principal threat posed by the NIROP by preventing endangerment of public health, welfare, or the environment by implementation of this Record

of Decision through hydraulic containment and recovery of all future migration of contaminated ground water from the NIROP and by recovery, to the extent feasible, of contamination downgradient of the NIROP.

The selected remedy includes installation and operation of ground water containment and recovery wells, with a two-phased plan for disposal of the ground water from the well system.

Under Phase I, the contaminated ground water from the containment and recovery well system will be discharged directly to the existing sanitary sewer system, for treatment at the local wastewater treatment facility. Pretreatment will be provided if necessary to meet local discharge requirements. Phase I activities will also include field testing of the recovered ground water, followed by design of a ground water treatment plant at the NIROP. Prior to start-up of the ground water containment system, the Navy will submit a ground water monitoring program for approval by the USEPA and MPCA, to confirm that containment of the ground water plume is effective.

During the first 90 days of recovery system operation, the Navy will collect data to determine whether hydraulic containment is being effectively achieved. This determination will be summarized in a document which will be sent to the USEPA and MPCA for review and approval at the end of the 90-day period. The USEPA and MPCA will provide written approval of, or comments on, the determination document within 30 days after its receipt. If the USEPA and MPCA do not approve the determination document, the Navy will submit a revised determination document to the USEPA and MPCA within 60 days after the Navy is notified of specific deficiencies in the document. If the determination document, after its approval by the USEPA and MPCA, indicates that effective hydraulic containment is not being provided by the ground water recovery system, the Navy will prepare and submit to USEPA and MPCA a written plan for upgrading the recovery system to assure that the performance objectives of the containment system are met, and the Navy will implement the finally approved plan.

Under Phase II, within 365 days after the USEPA and MPCA approve the determination that the ground water containment and recovery system is effective, design documents for a ground water treatment system will be completed by the Navy and approved by the USEPA and MPCA. Treated ground water will be discharged to the Mississippi River via a National Pollutant Discharge Elimination System (NPDES) storm sewer discharge.

A portion of the aquifer within the Anoka County Parkland closest to the Mississippi River may not fall within the zone of capture of the ground water recovery system. However, should this occur, contaminants in any uncaptured portion of the aquifer are expected to dissipate by natural means over time to levels that are protective of human health and the environment. Should the City of Minneapolis or another community decide in the future to develop a supplemental water supply well system in the Anoka County Parkland, the Navy will control the health risk within acceptable levels by implementation of a ground water treatment system or other measures as approved by the MPCA and the USEPA.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable, and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. Because this remedy may result in hazardous substances remaining in on-site ground water above health-based cleanup levels, a review will be conducted by the Navy, the USEPA, and the MPCA within 5 years after start-up of the ground water containment and recovery well system to ensure that the remedy continues to provide adequate protection of human health and the environment. This review will be conducted at least every 5 years as long as hazardous substances remain in ground water on-site above health-based cleanup levels.

United States Navy

By: Jacqueline E. Schafer — 25 September 1990
Date

ASSISTANT SECRETARY of the NAVY
(INSTALLATIONS & ENVIRONMENT) (Title)

Minnesota Pollution Control Agency

By: Gerald L. Willet — 9-26-90
Date

Commissioner (Title)

United States Environmental Protection Agency

By: Valdas V. Adamkus — 26 September 1990.
Date

REGIONAL ADMINISTRATOR (Title)
REGION 5

DECISION SUMMARY

1. SITE NAME, LOCATION, AND DESCRIPTION

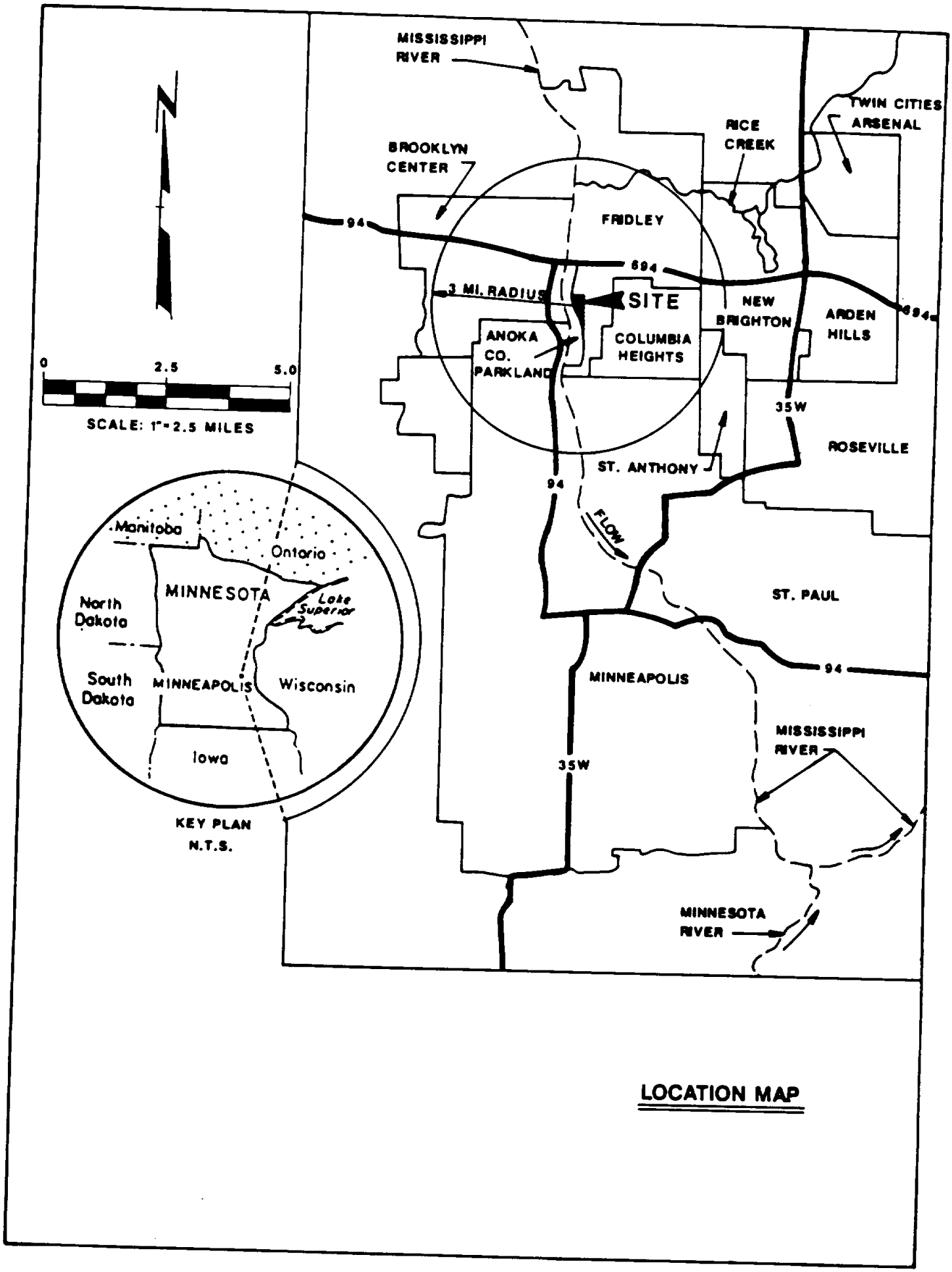
The Naval Industrial Reserve Ordnance Plant (NIROP) is located in the northern portion of the Minneapolis/St. Paul Metropolitan Area within the city limits of Fridley, Minnesota (Figure 1). Advanced naval weapons systems are designed and manufactured at the NIROP. The northern portion of the plant is government-owned and operated by a private contractor (FMC Corporation - Naval Systems Division), and the remainder of the plant is owned independently by FMC (Figure 2). The government-owned portion of the plant constitutes what is referred to within this document as "the NIROP." The word "site," wherever used in this document, includes the NIROP as well as the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action.

The NIROP comprises approximately 82.6 acres, most of which are covered with buildings or pavement. The NIROP is situated on a broad, flat outwash terrace which is approximately 30 feet above and 700 feet east of the Mississippi River.

Adjacent land use consists of the following:

- To the north - Commercial and light industrial
- To the south - Industrial
- To the west - Recreational
- To the east - Railyards and commercial/light industrial

Natural resource use in the area consists of recreational activities in the Anoka County Parkland, which is directly across East River Road from the NIROP, and on the Mississippi River. Use of these resources does not result in access to the NIROP itself, which is highly restricted by the Department of Defense. There are no federal or state fresh-water wetlands located within 1 mile of the site. No critical habitats of endangered species or national wildlife refuges have been identified in the vicinity of the site.



LOCATION MAP

FIGURE 1

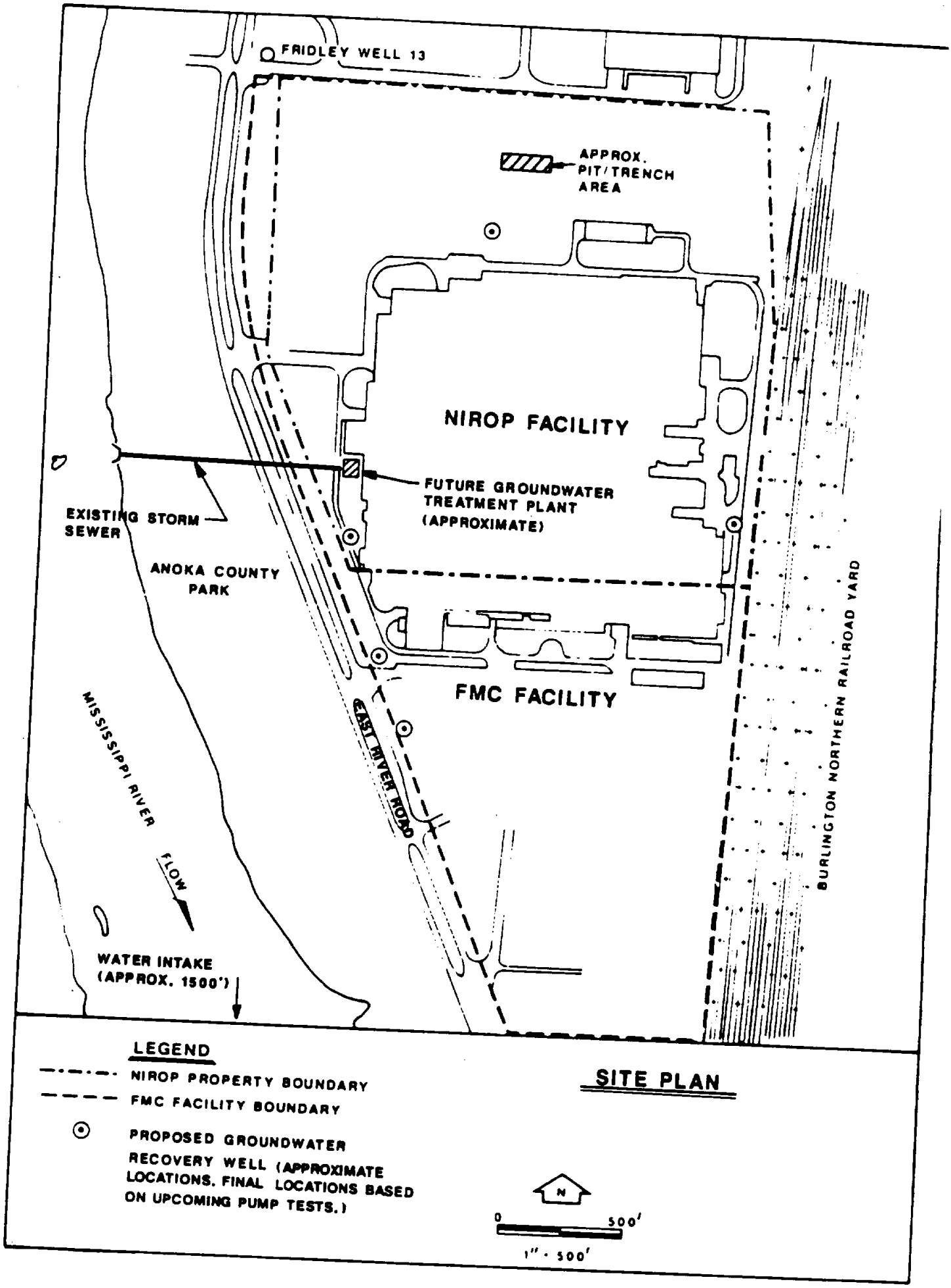

FRIDLEY WELL 13
APPROX. PIT/TRENCH AREA
NIROP FACILITY
FUTURE GROUNDWATER TREATMENT PLANT (APPROXIMATE)
EXISTING STORM SEWER
ANOKA COUNTY PARK
FMC FACILITY
EAST RIVER ROAD
MISSISSIPPI RIVER FLOW
WATER INTAKE (APPROX. 1500')
BURLINGTON NORTHERN RAILROAD YARD
LEGEND
NIROP PROPERTY BOUNDARY
FMC FACILITY BOUNDARY
PROPOSED GROUNDWATER RECOVERY WELL (APPROXIMATE LOCATIONS. FINAL LOCATIONS BASED ON UPCOMING PUMP TESTS.)
SITE PLAN
N
0
500'
1" = 500'

FIGURE 2

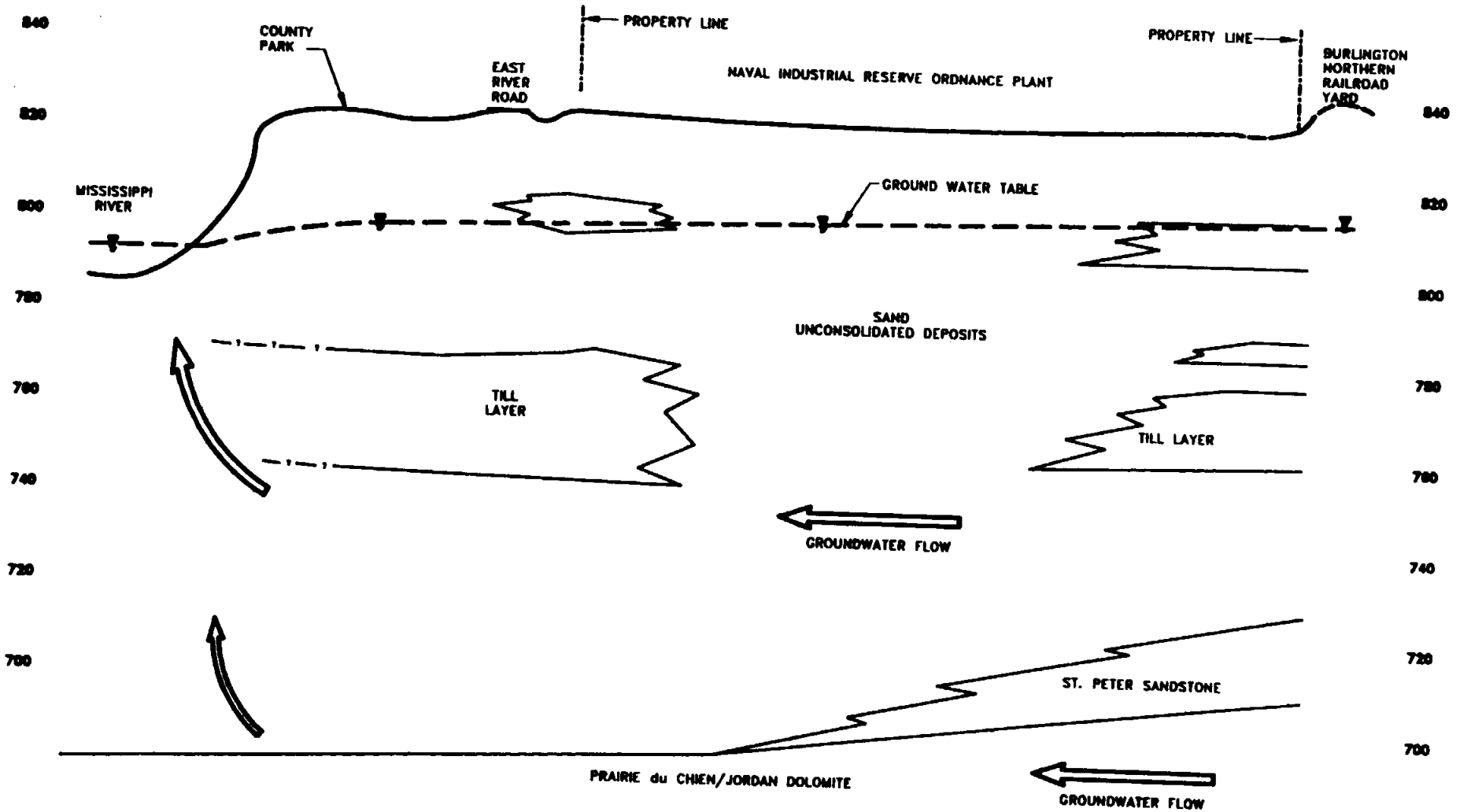
The City of Minneapolis water supply treatment plant withdraws water from the Mississippi River less than 1 mile downstream from the NIROP. The population of the area served by the City of Minneapolis Water Supply treatment plant is approximately 500,000 people.

Ground water use in the vicinity of the NIROP consists primarily of high-capacity industrial production wells which draw water from the Prairie du Chien/Jordan (PCJ) aquifer system. The City of Fridley maintains a backup potable water supply well (Fridley well 13 - Figure 2) which also draws water from the PCJ immediately north of the NIROP. During peak demand periods, Fridley Well 13 is used to supplement the current water supply system. The total population served by ground water within a 3-mile radius is 29,000 residents. Contamination has not been found above detection levels in Fridley Well 13. There are no ground water wells or users downgradient of the NIROP between the NIROP and the Mississippi River.

An aquifer within unconsolidated sediments overlies the PCJ in the vicinity of the NIROP. The thickness of the unconsolidated aquifer ranges from 100 feet to 140 feet under the NIROP. Except for an area at the southern end of the NIROP where the St. Peter Sandstone has been eroded, the unconsolidated aquifer is hydraulically separated from the PCJ by a silty to shaly layer of the St. Peter Sandstone, which acts as an aquitard. The unconsolidated aquifer is in contact and hydraulically connected with the PCJ in the eroded area, at the southern side of the NIROP. A conceptual representation of the aquifer and geology beneath the NIROP is shown on Figure 3.

The location of nearby populations is limited to a residential neighborhood approximately 200 feet east of the adjacent railyards.

There are presently no known major underground structures at the NIROP with the exception of typical industrial and utility piping. Previously disposed drums have been excavated and removed, as discussed in Section 2.



TYPICAL EAST–WEST CROSS SECTION

The FMC facility to the south of the NIROP has been the subject of separate response actions under CERCLA. A Record of Decision signed by the United States Environmental Protection Agency Regional Administrator on September 30, 1987, selected a site remedy consisting of ground water extraction to control a plume of contaminated ground water. The origins, migration, and remediation of the FMC plume are distinct from those at the NIROP. FMC has also excavated approximately 38,600 cubic yards of contaminated soil on the FMC facility to the south of the NIROP which were placed in an on-site storage vault served by a ground water monitoring system. The excavated area was capped with a multi-layer cover and revegetated.

2. SITE HISTORY AND ENFORCEMENT ACTIVITIES

A chronological summary of significant events and activities at the NIROP leading to the current remedial action is as follows:

1940 - 1941	Naval ordnance manufacturing facility was constructed; owned by the government and Northern Pump Company.
1942 - 1964	Northern Ordnance, Inc., a subsidiary of Northern Pump Company, operated the naval ordnance manufacturing complex.
1964	FMC Corporation purchased the southern portion of the manufacturing facility property from Northern Pump Company, and has remained the operating contractor to the U.S. Navy for the entire facility from 1964 to the present.
Early 1970s	Limited disposal at the NIROP of paint sludge and chlorinated solvents in pits and trenches was performed.
December 1980	Anonymous telephone call to the Minnesota Pollution Control Agency (MPCA) concerning past waste disposal practices at the NIROP.
March and April 1981	Trichloroethylene (TCE) identified at 0.035 to 0.200 mg/L in NIROP water supply wells No. 2 and 3 and FMC Well No. 1.
April 24, 1981	NIROP water supply wells shut down.
December 31, 1981	First quantifiable concentrations of TCE identified at the Minneapolis water treatment plant intake (0.0012 mg/L).

In response to these events, the following investigations, remedial actions, and CERCLA enforcement activities have taken place:

September 1980	U.S. Navy implemented the Navy Assessment and Control of Installation Pollutants (NACIP) program.
March 1982	The NACIP program was implemented at the NIROP.
May 1983	U.S. Navy authorized the current Installation Restoration (IR) program.

1983	Initial Assessment Study (IAS) at the NIROP was performed under NACIP. The IAS identified that drummed waste was disposed in the northern portion of the NIROP in 8- to 10-foot-deep trenches or pits. Ground water monitoring wells were installed and sampling began.
November 1983 - March 1984	Approximately 1,200 cubic yards of contaminated soil and 43 drums were excavated and disposed off-site in a USEPA-approved landfill.
May 22, 1984	The MPCA issued a Request for Response Action at the site to the U.S. Navy and FMC Corporation.
June 1986	A remedial investigation (RI) and feasibility study (FS) was initiated by the U.S. Army Corps of Engineers, for the U.S. Navy.
March 1987	All use of trichloroethylene at the NIROP was discontinued. 1,1,1-trichloroethane was put into use in place of trichloroethylene.
June 1987	Final RI report was issued. Additional investigations recommended.
November 1987 - February 1988	Additional investigations were performed at the NIROP.
July 1988	FS report and an Addendum to the RI report were issued.
August 1988	Addendum to the FS report was issued.
February 8, 1989	The U.S. Navy establishes the Technical Review Committee (TRC) for the project and convenes the first meeting. TRC membership includes the following: USEPA, MPCA, U.S. Navy, Corps of Engineers, Anoka County, City of Fridley, FMC Corp., Metropolitan Waste Control Commission, Minnesota Department of Natural Resources, and RMT, Inc.
April 13, 1989	TRC meeting #2 held.
May 22, 1989	Public meeting to present the RI/FS held in Fridley, Minnesota.
June 15, 1989	TRC meeting #3 held.
July 14, 1989	NIROP listed as a proposed site on the NPL by the USEPA.

September 13, 1989	TRC meeting #4 held.
November 21, 1989	NIROP listed as a final site on the NPL by the USEPA.
February 7, 1990	TRC Meeting #5 held.
May 1, 1990	U.S. Navy issues final Proposed Plan for ground water remediation after review by the MPCA and USEPA.
May 9, 1990	TRC Meeting #6 held.
May 9, 1990	Public meeting to present the Proposed Plan held in Fridley, Minnesota.
May 1, 1990 - May 30, 1990	Public comment period for the proposed ground water remedial action.
May 22, 1990	Special Notice letter from USEPA received at the NIROP.

3. COMMUNITY RELATIONS HISTORY

A statement of the basis and purpose of the selected action can be found on page 1 of this document. The RI/FS documents and Proposed Plan were made available to the public in both the Administrative Record and information repositories maintained at the USEPA Region V Docket Room in Chicago and the Anoka County Library in Fridley. The notice of availability of these documents and a notice for the public meeting were published in various local and area newspapers. Fact sheets explaining the Proposed Plan were mailed to approximately 400 residents prior to the public meeting. Copies of the Proposed Plan were mailed to TRC members and other interested local officials.

The public comment period occurred from May 1 to May 30, 1990. A public meeting was held on May 9, 1990, at the Fridley Community Education Center. At this meeting, representatives from the U.S. Navy, USEPA, and the Minnesota Pollution Control Agency (MPCA) answered questions about the NIROP and the Proposed Plan. Responses to verbal, as well as written, public comments are contained in the Responsiveness Summary included in this Record of Decision.

Prior to the public comment period in May 1990, there was limited community involvement in activities at the NIROP. In May 1989, newspaper announcements were placed for a public meeting presented by the U.S. Navy and other members of the Technical Review Committee in Fridley on May 22, 1989, to discuss the results of the RI/FS. There was no attendance at this meeting.

Local input to the selection of the preferred remedy has come predominantly through the Technical Review Committee (TRC) established by the U.S. Navy in February 1989. TRC membership has included the USEPA, the MPCA, the U.S. Navy, the Corps of Engineers, Anoka County, the City of Fridley, FMC Corp., the Metropolitan Waste Control Commission, the Minnesota Department of Natural Resources (MDNR), and RMT, Inc. Subsequent meetings have been held in April, June, and September 1989, and in February and May 1990. Involvement through the TRC has facilitated remedial planning and has alerted local groups to the proposed activities.

4. SCOPE AND ROLE OF OPERABLE UNIT WITHIN SITE STRATEGY

Prior to the RI/FS work for this site, the Navy had conducted a removal action in 1983 and 1984 to address the immediate threat of hazardous substances posed by past waste disposal practices. Approximately 1,200 cubic yards of contaminated soil and 43 drums were excavated and disposed off-site in a USEPA-approved landfill.

The RI/FS work for this site addressed both the soil and ground water media. During the evaluation of alternatives, it was determined that the available data were not sufficient to determine an appropriate response, if any was required, for contaminated soil. Additional investigative work concerning the source of the contamination was requested by the USEPA and MPCA and is presently being organized by the U.S. Navy.

This ROD addresses the remedial action planned for a ground water operable unit at the site. The principal threat posed by the site is the continuing migration of TCE via ground water to the Mississippi River. This remedial action addresses the principal threat by providing total hydraulic containment to prevent migration of all contaminated ground water off the NIROP, and by recovering, to the extent feasible, contaminated ground water beneath the Anoka County Parkland. The need for future action, possibly as a separate operable unit, to address potential contamination sources at the NIROP will be addressed pending the results of the upcoming investigative work.

The Navy believes that the combination of source remediation, if any subsequent RI/FS concerning the source indicates such remediation is necessary, and ground water remediation should address all contamination at the site. By remediation of contaminated soils, if found to be present, contaminant loading to ground water and risks posed by the contaminated soils at the NIROP would be reduced. By remediation of contaminated ground water, the Navy believes that present and future risks posed by migration of contaminated ground water will be reduced. This remedial action for hydraulic containment and recovery of ground water at the NIROP, and to the extent feasible, ground water downgradient of the NIROP, will stop future migration of contaminated ground water from the NIROP and will provide protection to the City of Minneapolis water supply intake.

5. SUMMARY OF SITE CHARACTERISTICS

The first phase of the remedial investigation began in June 1986, and an RI report was submitted in June 1987. Based on the initial RI work, a follow-up investigation was performed between November 1987 and February 1988. An RI addendum report was submitted in July 1988.

Analysis of information gathered during the two phases of the remedial investigation indicates the site characteristics listed below.

TCE Usage and Potential Source Areas

- All use of TCE at the NIROP was discontinued by April 1, 1987. Plant operations which previously used TCE now use 1,1,1-trichloroethane. A solvent management program is currently in place at the NIROP, and disposal of solvents is in accordance with state and federal regulations.
- Elevated concentrations of TCE and dichloroethylene were found in soil pore gas near the former pit/trench disposal area, near a concrete pad in the north storage yard area, and at several locations near the north property boundary.
- The former pit/trench disposal area (and immediate vicinity) in the northern region of the NIROP is considered an on-site source area. Findings from the soil pore gas survey and on-going occurrence of TCE in the ground water suggest that it is likely that some VOC residuals and/or VOC-contaminated soil still exist in this area. Investigations showed TCE at the intermediate depth of the unconsolidated aquifer in the southeast corner of the NIROP.
- Unidentified sources are suspected at the NIROP near the eastern NIROP property boundary, and east and northeast of the NIROP property.
- Because TCE is present in upgradient wells, upgradient sources may also be contributing to ground water contamination originating at the NIROP.
- The NIROP includes controlled access to plant grounds and buildings.
- TCE is a probable human carcinogen. Remediation of TCE will concurrently address risks posed by other constituents.

Hydrogeology

- Site hydrogeology consists of an unconsolidated sand and gravel aquifer overlying a bedrock aquifer. The unconsolidated aquifer consists of 85 feet of saturated thickness. The water table is 20 to 25 feet below the surface. A discontinuous till layer is present at approximately 50 to 80 feet (Figure 3).

- The underlying bedrock consists of the Prairie du Chien/Jordan (PCJ) dolomite. The St. Peter Sandstone overlies the PCJ across the northern portion of the NIROP. The St. Peter Sandstone acts as a confining layer where it is present; where it is absent, the unconsolidated aquifer is hydraulically connected to the PCJ.

- Ground water flow in the unconsolidated aquifer is generally from the northeast to the southwest across the NIROP. The aquifer discharges to the Mississippi River, and is the predominant migration pathway.

- There are currently no ground water users downgradient of the NIROP in the Anoka County parklands. The United States Geological Survey (USGS) has studied the parklands for potential development of a supplemental water supply system for the City of Minneapolis. No decision has been made to date on whether any community in the area will install wells in the future for a water supply in Anoka County Park land downgradient of the NIROP.

Extent of Migration via Ground Water

- Ground water in the unconsolidated aquifer beneath the NIROP contains volatile organic compounds (VOCs), including the following: TCE, 1,1,1-trichloroethane, 1,2-dichloroethylene, tetrachloroethylene, 1,1-dichloroethane, toluene, xylene, and ethylbenzene. Concentrations of these constituents are listed in Table 1.

- TCE was found more frequently and at higher concentrations than any other VOC, and is therefore the best indicator chemical. The approximate extent of TCE in ground water is illustrated on Figures 4 and 5.

- Concentrations of TCE in ground water reaching the Mississippi River are probably on the order of 1 to 10 mg/L. This range of TCE concentrations can be expected to continue if no remedial action is taken, given the TCE levels detected at the southwest corner of the NIROP.

- The investigations show concentrations of VOCs below drinking water standards in the Prairie du Chien bedrock aquifer.

Extent of Migration via Storm Sewers

- One round of samples was collected from storm sewers serving the NIROP. No VOCs were found.

TABLE 1

RANGE OF VOCs IN GROUND WATER (mg/L)

CONSTITUENT	MCL	UPGRADIENT WELLS		ON-SITE WELLS		DOWNGRADIENT WELLS	
		SHALLOW	DEEP*	SHALLOW	DEEP*	SHALLOW	DEEP*
Trichloroethylene	0.005	< 0.005 - 0.17	< 0.005 - 0.004	< 0.005 - 28.0	< 0.005 - 37.0	< 0.005 - 12.7	< 0.005 - 10.8
1,1,1-Trichloroethane	0.20	< 0.005 - 0.002	< 0.005	< 0.005 - 0.39	< 0.005 - 0.287	< 0.005	< 0.005 - 0.0086
1,2-Dichloroethylene	NP	< 0.005	< 0.005	< 0.005 - 0.31	< 0.005 - 1.41	< 0.005 - 2.44	< 0.005 - 0.092
Tetrachloroethylene	0.005	< 0.005 - 0.001	< 0.005	< 0.005 - 0.22	< 0.005 - 0.141	< 0.005 - 0.021	< 0.005
1,1-Dichloroethane	NP	< 0.005	< 0.005 - < 0.010	< 0.005 - 0.066	< 0.005 - 0.106	< 0.005 - 0.009	< 0.005 - 0.003
Toluene	NP	< 0.005	< 0.005	< 0.005 - 0.010	< 0.005 - 0.012	< 0.005	< 0.005 - 0.0082
Xylene	NP	< 0.005	< 0.005	< 0.005	< 0.005 - 0.036	< 0.005	< 0.005
Ethylbenzene	NP	< 0.005	< 0.005	< 0.005 - 0.037	< 0.005 - 0.21	< 0.005	< 0.005

* Deep wells include piezometers installed at various depths in the unconsolidated aquifer. VOCs were not detected in bedrock wells above MCLs.

NP - No MCL Promulgated.

Values listed which are below the detection limit (0.005 mg/L) are estimated values ("J" qualifiers).

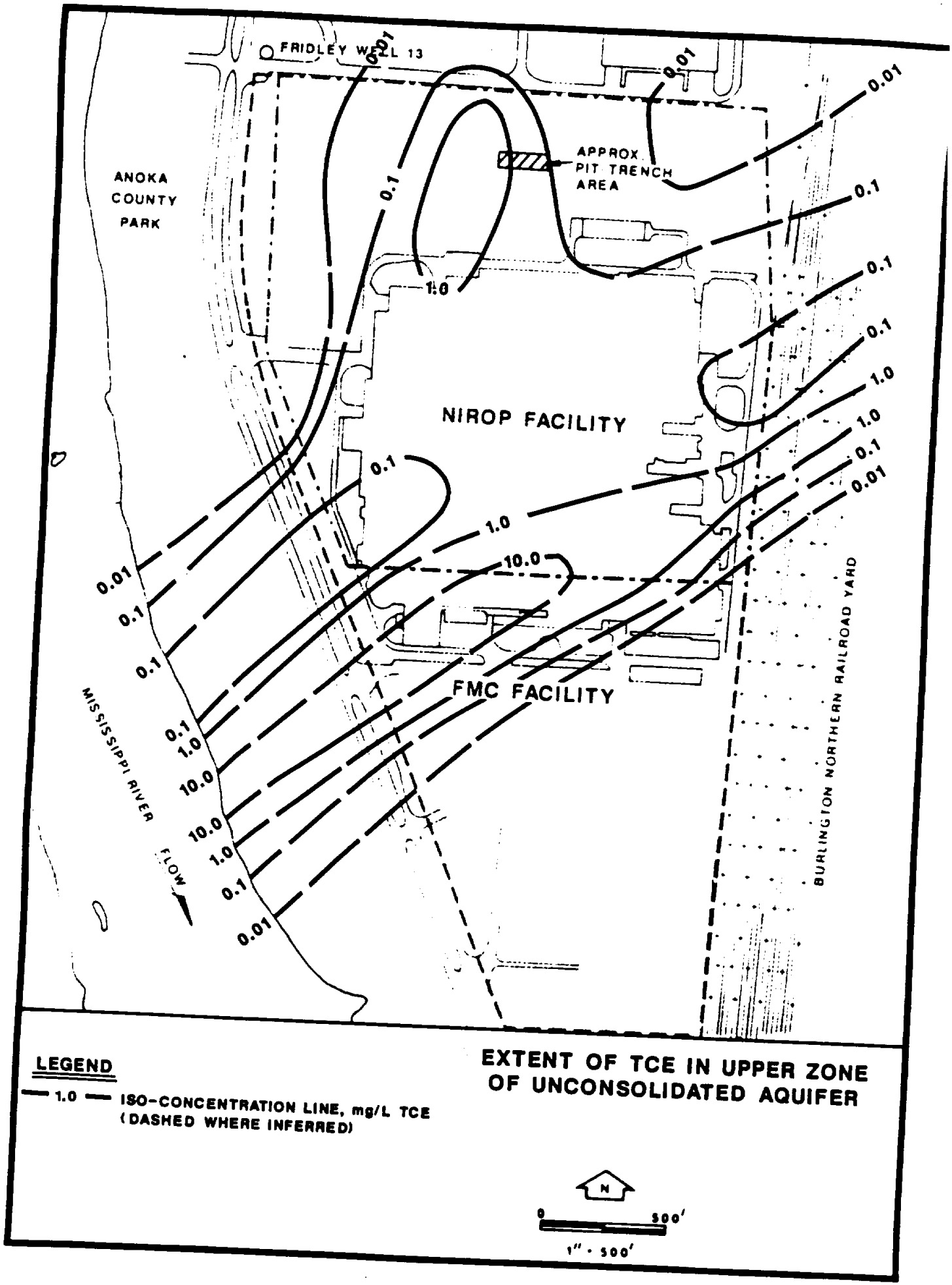

FRIDLEY WELL 13
ANOKA COUNTY PARK
APPROX. PIT TRENCH AREA
NIROP FACILITY
FMC FACILITY
MISSISSIPPI RIVER
FLOW
BURLINGTON NORTHERN RAILROAD YARD
0.01
0.1
1.0
10.0
LEGEND
1.0 ISO-CONCENTRATION LINE, mg/L TCE (DASHED WHERE INFERRED)
EXTENT OF TCE IN UPPER ZONE OF UNCONSOLIDATED AQUIFER
N
0
500'
1" = 500'

FIGURE 4

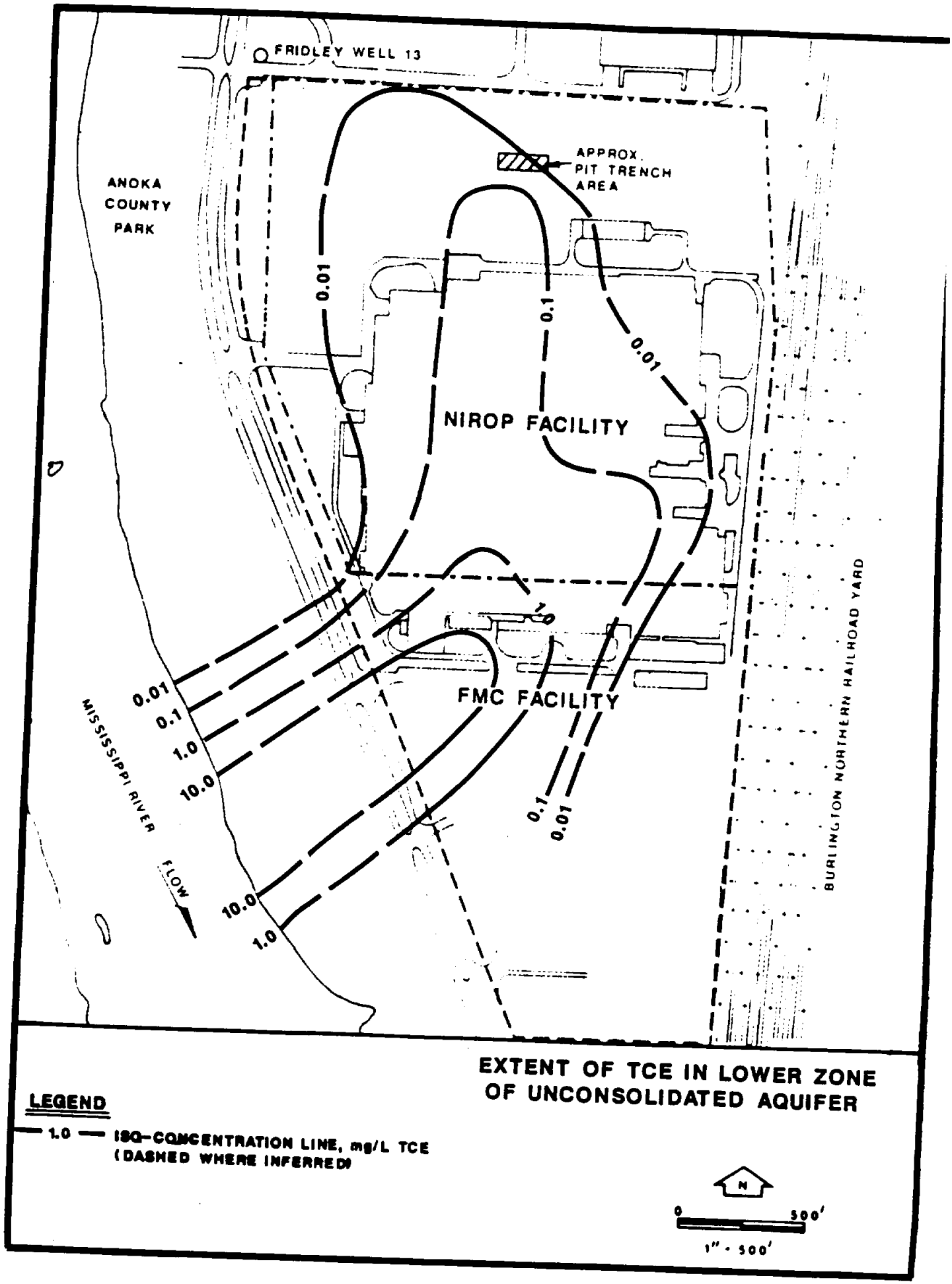

FRIDLEY WELL 13
APPROX. PIT TRENCH AREA
ANOKA COUNTY PARK
NIROP FACILITY
FMC FACILITY
BURLINGTON NORTHERN RAILROAD YARD
MISSISSIPPI RIVER
FLOW
0.01
0.1
1.0
10.0
EXTENT OF TCE IN LOWER ZONE OF UNCONSOLIDATED AQUIFER
LEGEND
1.0 — ISO-CONCENTRATION LINE, mg/L TCE (DASHED WHERE INFERRED)
N
0
500'
1" = 500'

FIGURE 5

6. SUMMARY OF SITE RISKS

Actual Human Risks

The primary concern resulting from contamination from the NIROP is human ingestion of VOC contaminants in ground water, either directly or via the Minneapolis water treatment plant intake on the Mississippi River. Concern is focused on trichloroethylene (TCE) since it represents the predominant constituent at the NIROP and has been widely detected in concentrations above the drinking water standards Maximum Contaminant Level (MCL) in ground water. Of the highest observed VOC concentrations in shallow and deep wells downgradient of the NIROP, TCE accounts for over 90 percent of the total VOCs. Other constituents pose considerably lower risks in comparison to TCE; therefore, TCE provides a good indicator of total risk. In addition, remediation designed to recover TCE will concurrently address other constituents.

In the short term, the only potential point of significant human exposure is via ingestion of drinking water from the Minneapolis water treatment plant. The intake for the plant is located on the Mississippi River approximately 1,500 feet south of the NIROP, and could potentially be affected by ground water entering the river near the NIROP. Based on RI data, it was estimated that ground water entering the river would mix with from 10 to 100 percent of the total river flow before reaching the city water treatment plant intake farther downstream. It was assumed that there would be no volatilization or other losses of TCE within the river or during the treatment process within the city water treatment plant.

TCE is a probable human carcinogen. As a result, the excess lifetime cancer risk to the exposed population would be approximately 2×10^{-5} and 2×10^{-6}, respectively, under 10- and 100-percent mixing estimates using the 7-day, 10-year low river flow and a typical TCE concentration in the ground water discharge of 10 mg/L. These risk estimates are based on the assumed presence of TCE in the city water treatment plant intake. No TCE has been found in samples collected annually by FMC at the intake for the past 3 years, at a detection

limit of 5 µg/L. Therefore, if an exposed population does not exist, the actual risk is zero. TCE had been previously detected in 26 of 40 samples collected by the MPCA from 1981 to 1983 at the city water treatment plant intake, at concentrations less than 5 µg/L.

Potential Human Risks

Possible future effects on public health would vary depending on whether the concentration of TCE in ground water discharging to the river increases or decreases. In the long term, possible future effects may also include the creation of a completely new exposure pathway. At the present time, there is no consumption of ground water or surface water between the NIROP property line and the city water treatment plant intake on the Mississippi River approximately 1,500 feet south of the NIROP. The installation of a new water supply well downgradient of the NIROP, before ground water enters the river, would create a new exposure pathway. The United States Geological Survey (USGS) has investigated the suitability of this area for supplemental water supply purposes for the City of Minneapolis. Although no decisions have yet been made on whether or not to use ground water from this area, the existing contamination is one factor that would influence the selection of this potential water source area. Since ground water in this location contains higher concentrations of VOCs than would exist at the city intake, the risk level would increase under such an exposure scenario.

Maximum and typical ground water VOC concentrations in downgradient wells are listed in Table 2 with the corresponding potential risk. These risks represent the risks associated with ingestion of ground water. Since the exact exposure point concentration is not known, and may change in the future, the range of typical values reported in Table 2 represents typical concentrations encountered in ground water which may be recovered under the future use scenario. TCE accounts for the majority of risk in comparison to other carcinogens.

TABLE 2

POTENTIAL RISKS ASSOCIATED WITH VOCs IN GROUND WATER DOWNGRADIENT OF THE NIROP

Carcinogen	Concentration (mg/L)		CDI[1] (mg/kg-d)		CSF[2] $(mg/kg\text{-}d)^{-1}$	Potential Risk	
	Maximum	Typical	Maximum	Typical		Maximum	Typical
Trichloroethylene	12.7	1-10	0.363	0.028-0.28	$1.1\ E^{-2}$	$4\ E^{-3}$	$3\ E^{-4} - 3\ E^{-3}$
Tetrachloroethylene	0.21	< 0.003	0.0006	< 0.00014	$5.1\ E^{-2}$	$3\ E^{-5}$	$< 7\ E^{-6}$
1-1-Dichloroethane	0.009	< 0.005	0.0003	< 0.00014	$9.1\ E^{-2}$	$2\ E^{-5}$	$< 1\ E^{-5}$
					TOTAL	$4\ E^{-3}$	$3\ E^{-4} - 3\ E^{-3}$

(1) CDI = Chronic Daily Intake

(2) Source: USEPA, January/April 1990. Health effects assessment summary tables: First/second quarter 1990. OERR 9200.6 - 303(90-1/2). CSF = Cancer Slope Factor

The land between the NIROP property and the Mississippi River currently serves as a park owned by Anoka County. Access to existing potable water supplies provided along East River Road is available, which would eliminate the necessity for installation of any new water supply well in the parkland immediately downgradient of the NIROP. However, if ground water in the narrow strip of parkland between the NIROP and the Mississippi River is used in the future for potable water supplies, the Navy will control the health risk within acceptable levels by implementation of a ground water treatment system or other measures as approved by the MPCA and the USEPA. (This alternative was evaluated during the FS.)

Actual or Potential Environmental Risks

Potential environmental risks resulting from present conditions at the site consist of ingestion or uptake of TCE and other VOCs by aquatic organisms in the Mississippi River. Since VOCs readily evaporate from surface waters and since they typically do not bioaccumulate, the risk to aquatic organisms is not believed to be significant. The acute and chronic Ambient Water Quality Criteria for TCE are 45.0 and 21.9 mg/L, respectively. The typical range of TCE in the plume migrating to the river is 1 to 10 mg/L (maximum value = 12.7 mg/L), indicating that these criteria will not be exceeded.

7. DESCRIPTION OF ALTERNATIVES

The Feasibility Study developed a total of eight remedial alternatives to respond to the conditions defined during the remedial investigation. These alternatives addressed both soil and ground water at the NIROP, although the preferred alternative presently addresses only the ground water operable unit, pending additional investigation of soil at the NIROP.

No-Action Alternative

The Superfund program requires that the "no-action" alternative be considered at every site. Under this alternative, no specific action would be taken to prevent exposure to soil or ground water at the NIROP. A long-term ground water monitoring program would be developed and implemented using previously installed monitoring wells to further assess present and future conditions.

Alternative A: Capping

This alternative consists of the construction of a 6,000-square-foot concrete cap over a potential source area of ground water contamination at the NIROP. The contamination source addressed by this alternative is the residual concentrations of VOCs contained in soil in the vicinity of the previous pit/trench disposal area located at the north end of the NIROP. This alternative would reduce infiltration and subsequent contaminant loading to ground water. The area would be graded to promote surface water drainage away from the cap. Precipitation which accumulates on the cap would be drained via modifications to the facility's storm water collection system. A long-term ground water monitoring program would also be implemented.

Alternative B1: Soil Excavation and Disposal in an Off-site Landfill

This alternative consists of the excavation of approximately 300 cubic yards of soil containing residual concentrations of VOCs, and disposal in an off-site RCRA Subtitle C landfill. Excavation would be centered around the trench locations originally excavated in 1983. This alternative would reduce contaminant loading to the ground water. The excavation would be backfilled with clean soil. A long-term ground water monitoring program would be implemented.

Alternative B2: Soil Excavation and Disposal in a Landfill at the NIROP

This alternative is analogous to alternative B1 with the exception that disposal would be in a newly constructed RCRA-permitted landfill at the NIROP.

Alternative C: Soil Excavation Treatment and Disposal

This alternative would consist of the aeration of approximately 300 cubic yards of excavated soil at the NIROP prior to backfilling in the original excavation. VOCs would be removed down to an established treatment performance level.

Alternative D: Soil Treatment Using <u>In-situ</u> Vacuum Extraction

This alternative involves treatment of soil in the vicinity of the former disposal pits and trenches. <u>In-situ</u> vacuum extraction technology would be used to remove residual concentrations of VOCs by inducing a negative pressure on the unsaturated soil. Enhanced airflow through the soil would volatilize adsorbed constituents, and the recovered air would be vented to the atmosphere. If necessary, the system would be equipped with air treatment equipment to meet local air emission requirements. A long-term ground water monitoring program would be implemented.

Alternative E: Ground Water Pumping and Disposal

This alternative consists of ground water recovery using a series of pumping wells and direct discharge to the Metropolitan Waste Control Commission sanitary sewer system. An option to discharge directly to local storm sewers was also considered.

Alternative F: Ground Water Pumping Treatment and Disposal

This alternative involves the pumping of ground water from source areas and downgradient locations. For evaluation purposes, it was assumed that five hydraulic containment and recovery wells would operate at a combined flow rate of up to 650 gpm. Although various disposal options were considered, the base-line alternative specified a phased ground water remediation plan. Under Phase I, recovered ground water would be discharged to the Metropolitan Waste Control Commission (MWCC) sanitary sewer system, where it would be treated at the Pig's Eye Wastewater Treatment Plant. Pre-treatment would be used, if necessary, to meet MWCC requirements.

During Phase II, one of two treatment process options would be incorporated into the pumping program, pending the results of testing on recovered water during Phase I:

Option A: Treatment of ground water at the NIROP by two-stage air stripping, with disposal through an existing NPDES-permitted storm sewer outfall, and treatment of air emissions using vapor-phase granular activated carbon. Spent activated carbon would be regenerated at a permitted off-site facility.

Option B: Treatment of ground water at the NIROP using aqueous-phase granular activated carbon, with disposal through an existing NPDES-permitted storm sewer outfall. Spent activated carbon would be regenerated at a permitted off-site facility.

Two additional alternatives were presented in the Feasibility Study to address the possibility that the City of Minneapolis may decide to develop a supplemental water supply well system downgradient of the NIROP, located within the TCE plume. One of these alternatives included a "point of use" ground water treatment system utilizing granular

activated carbon, to be installed at the location of the potential well field. Spent activated carbon from the treatment system would be regenerated at a permitted off-site facility. The second additional alternative considered the possibility of relocating the proposed water supply well system, and providing additional piping and construction easements, as necessary. The alternatives would be available if future decision-making called for development of a supplemental water supply system in the Anoka County Parkland.

8. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

8.1 Overall Protection of Human Health and the Environment

The No-Action alternative would not provide increased protection of human health or the environment above existing conditions.

Alternative A would reduce potential contaminant loadings to ground water over the long term, but would not reduce potential exposures from existing conditions.

Similarly, Alternatives B1, B2, C, and D would remove a long-term source of contaminant loading by excavation and/or treatment. However, Alternative B1 would result in re-disposal of NIROP materials at an off-site disposal facility, which could result in possible future migration from the off-site facility. None of these alternatives address the more immediate potential exposures resulting from constituent migration via ground water.

Alternatives E and F would provide a high degree of overall protection by reducing potential ingestion of VOCs in ground water affected by the NIROP, and by mitigating continued discharge of VOCs to the Mississippi River. Alternative F would be implemented with state and local discharge approvals that specify protective levels for air and water emissions.

8.2 Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

For soil, chemical-specific ARARs have not been identified. Certain remedial alternatives would be subject to action-specific ARARs under the Resource Conservation and Recovery Act (RCRA) for source area capping (Alternative A) and soil disposal (Alternatives B1 and B2). RCRA treatment standards may also be ARARs for soil treatment under Alternative C. Off-site disposal would be subject to RCRA land disposal restrictions.

For ground water, the Maximum Contaminant Level (MCL) for TCE has been identified as relevant and appropriate as a ground water cleanup target at the site. Alternatives E and F would seek to meet this ARAR by hydraulic containment and direct

ground water removal. Alternatives A, B1, B2, C, and D would provide source control, but would not directly meet the MCL ARARs for ground water.

Discharges of ground water under Alternatives E and F would meet local and state requirements. Air emissions under Alternatives D and F (and possibly C) would be subject to state air emission requirements.

A summary of major ARARs for each alternative is provided in Table 3.

8.3 Long-Term Effectiveness and Permanence

The No-Action alternative would provide no long-term effectiveness or permanence.

The remaining alternatives would provide long-term effectiveness in varying ways. Alternatives E and F would provide long-term migration control and permanent contaminant removal from the saturated zone, but not the unsaturated zone. Alternatives A, B1, B2, C, and D would permanently remove contaminant sources in the unsaturated zone, with the likely result of a gradual improvement in ground water quality over time.

8.4 Reduction of Toxicity, Mobility, and Volume

The No-Action alternative would not reduce the toxicity, mobility, or volume of contaminants in soil or ground water.

Alternative A would reduce future mobility of contaminants from unsaturated soil to ground water by limiting the infiltration of precipitation, but would not reduce toxicity or volume.

Alternatives B1, B2, C, and D would reduce mobility, toxicity, and volume by removing a contaminant source. Alternative B1 would provide the highest degree of reduction by disposal of excavated soil off-site. Alternatives C and D would transfer contaminants from a solid matrix to the air matrix, with possible recovery and destruction of contaminants from the air matrix under Alternative D.

TABLE 3 ACTION-SPECIFIC ARARS	
No Action	RCRA Subtitle C, Subpart F, Ground Water Monitoring
A. Capping	RCRA Subtitle C, Subpart F and Capping Requirements
B1. Soil Excavation and Disposal in an Off-Site Landfill	RCRA Subtitle C, Subpart F; DOT Transport Requirements; Land Disposal Restrictions
B2. Soil Excavation and Disposal in a Landfill at the NIROP	RCRA, Subtitle C, Subpart F, TSD Requirements, Closure and Minimum Technology Requirements
C. Soil Excavation, Treatment, and Disposal	RCRA Subtitle C, Subpart F, TSD Requirements, Closure and Minimum Technology Requirements; CAA - NAAQs for VOCs
D. Soil Treatment Using In-Situ Vacuum Extraction	RCRA Subtitle C, Subpart F, TSD Requirements; CAA - NAAQs for VOCs
E. Ground Water Pumping and Disposal	RCRA Subtitle C, Subpart F; MWCC Pretreatment Requirements; NPDES Permit for Storm Sewer Discharge
F. Ground Water Pumping, Treatment, and Disposal	
Option A: Air Stripping	RCRA Subtitle C, Subpart F, TSD Requirements; CAA - NAAO's for VOCs; CWA - NPDES for VOCs; WQS - MCLs; Land Disposal Restrictions and DOT Requirements for Spent Activated Carbon.
Option B: Aqueous Granular Activated Carbon	RCRA Subtitle C, Subpart F, TSD Requirements; CWA - NPDES for VOCs; WQS - MCLs; Land Disposal Restrictions and DOT Requirements for Spent Activated Carbon.

Alternatives E and F provide direct reductions in the toxicity, mobility, and volume of contaminants in ground water. Emissions of contaminants via air or water discharges would be within state limits.

8.5 Short-Term Effectiveness

The No-Action alternative would provide no short-term effectiveness.

Alternatives E and F would provide the highest degree of effectiveness in the short term by directly mitigating the movement of constituents via ground water to the Mississippi River and potential subsequent receptors.

Alternatives A, B1, B2, C, and D would provide limited short-term effectiveness because they primarily address constituents only in the unsaturated zone. They would not provide immediate migration control.

8.6 Implementability

All of the alternatives are implementable. Alternative A is the most straightforward from an engineering standpoint, and would involve simple construction methods. Alternative B1 is also straightforward, but implementation would require off-site disposal approval.

Alternatives B2, C, and D would involve either more sophisticated construction techniques or a form of soil treatment. Although more complex, they are readily implementable.

Alternatives E and F would involve a relatively higher degree of uncertainty due to the complexities of ground water flow and recovery technology. This can be overcome by a program of effectiveness monitoring and treatment monitoring, with system adjustments as needed. Discharge approvals would be required.

8.7 Costs

The estimated capital and total present worth costs for each alternative are summarized below.

Alternative	Estimated Costs ($1,000s)	
	Capital	Total Present Worth*
No Action	40	490
A Capping [2]	210	310
B1 Excavation and Off-Site Disposal [1]	170	170
B2 Excavation and Disposal at the NIROP [1]	370	530
C Excavation, Treatment, and Disposal [1]	150	150
D In Situ Vacuum Extraction [2]	1,000	1,000
E Pump and Dispose of Ground Water [1]	320	7,300
F Pump, Treat, and Dispose of Ground Water [2]		
Option 1: Air Stripper	1,100	3,700
Option 2: GAC	800	4,100

GA - Granular Activated Carbon

* - Present worth based on 30-year period and 10% interest rate.

Note: For Alternative E, a substantial portion of the estimated present worth is due to an estimated publicly owned treatment works (POTW) discharge fee at $1.08 per 1,000 gallons of water.

Source:

[1] RMT, Inc. 1988. Feasibility Study Report.

[2] RMT, Inc. 1988. Feasibility Study Addendum Report.

8.8 Agency Acceptance

The MPCA and the USEPA have provided comments on the RI and FS. The MPCA and the USEPA agree with the recommended remedial action for a ground water operable unit.

8.9 Community Acceptance

The community has not been strongly for or against any one of the alternatives. Several questions have been raised over whether implementation of Alternative F would deplete a ground water resource which may have otherwise had beneficial uses. The hydrogeologic setting at the site has been reviewed, and it has been determined that pumping of shallow ground water at the NIROP will not adversely affect other potential users. These questions have also been addressed in the Responsiveness Summary.

9. THE SELECTED REMEDY

The selected remedial alternative to address the presence and migration of TCE and other constituents in ground water at the NIROP is Alternative F: Ground Water Pumping, Treatment, and Disposal. The objective of this alternative is to address the principal threat posed by the site by providing hydraulic containment to prevent further migration of contaminated ground water off the NIROP and by recovering, to the extent feasible, contaminated ground water beneath the Anoka County Parkland. Based on the results of the RI/FS, this alternative provides the best balance among the alternatives with respect to the nine evaluation criteria specified under the National Contingency Plan.

The selected remedy will provide long-term effectiveness in satisfying the objective of reducing future exposures to VOCs in ground water. The alternative provides a high degree of permanence by recovering contaminated ground water at the site and treating contaminated ground water using approved and proven methods. Future migration and potential exposure to ground water beneath the Anoka County Parkland will be mitigated. In this manner, both the mobility and volume of VOCs migrating to the Mississippi River are reduced.

The initial goal of the selected alternative is to contain and recover contaminated ground water from both the NIROP and, to the extent feasible, the Anoka County Parklands. The targeted capture zone is illustrated on Figure 6. The ultimate goal is to restore ground water quality in the unconsolidated aquifer at the site to Maximum Contaminant Levels (MCLs). These goals comply with all identified Applicable or Relevant and Appropriate Requirements (ARARs).

A portion of the aquifer within the Anoka County Parkland closest to the Mississippi River may not fall within the zone of capture of the ground water recovery system. However, should this occur, contaminants in any uncaptured portion of the aquifer are expected to dissipate by natural means over time to levels that are protective of human health and the

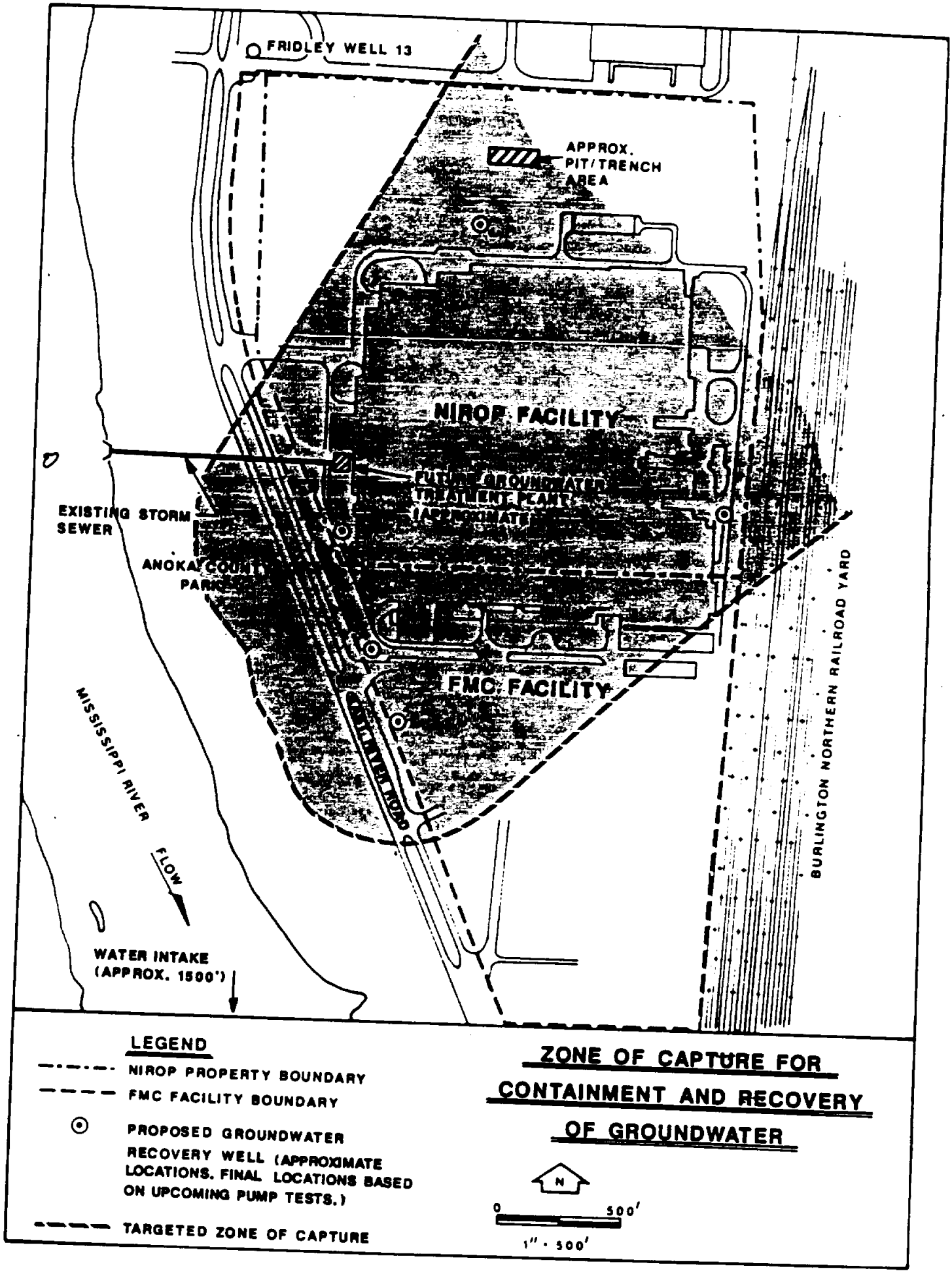

FRIDLEY WELL 13
APPROX. PIT/TRENCH AREA
NIROP FACILITY
EXISTING STORM SEWER
ANOKA COUNTY PARK
FMC FACILITY
MISSISSIPPI RIVER FLOW
WATER INTAKE (APPROX. 1500')
BURLINGTON NORTHERN RAILROAD YARD
LEGEND
NIROP PROPERTY BOUNDARY
FMC FACILITY BOUNDARY
PROPOSED GROUNDWATER RECOVERY WELL (APPROXIMATE LOCATIONS. FINAL LOCATIONS BASED ON UPCOMING PUMP TESTS.)
TARGETED ZONE OF CAPTURE
ZONE OF CAPTURE FOR CONTAINMENT AND RECOVERY OF GROUNDWATER
N
0
500'
1" = 500'

FIGURE 6

environment. Should the City of Minneapolis or another community decide in the future to develop a supplemental water supply well system in the Anoka County Parkland, the Navy will control the health risk within acceptable levels by implementation of a ground water treatment system or other measures as approved by the MPCA and the USEPA.

Components of the Selected Remedy

The design concepts for the selected remedy as developed in the Feasibility Study (FS) are illustrated on Figure 7, and include the following:

Phase I

- **Installation and operation of five ground water recovery wells at a combined design flow rate of up to 650 gpm.** Two wells will be installed at source locations to capture the ground water plume containing higher concentrations of TCE. The three remaining wells will be installed at the downgradient side of the NIROP to control migration and recover ground water which has already moved off the NIROP to the fullest extent possible.

- **Discharge of ground water to the local sanitary sewer.** The discharge will meet local regulations, and the water will be treated at the Metropolitan Waste Control Commission (MWCC) Pig's Eye Wastewater Treatment Facility. If necessary to meet MWCC requirements, pretreatment will be provided.

- **Testing and design of a treatment system located at the NIROP.** During Phase I, testing will be performed on pumped ground water to establish design parameters for the full-scale treatment system. The phased approach to the ground water remediation will allow the start-up of ground water recovery operations while testing, remedial design, and construction of the treatment system proceed.

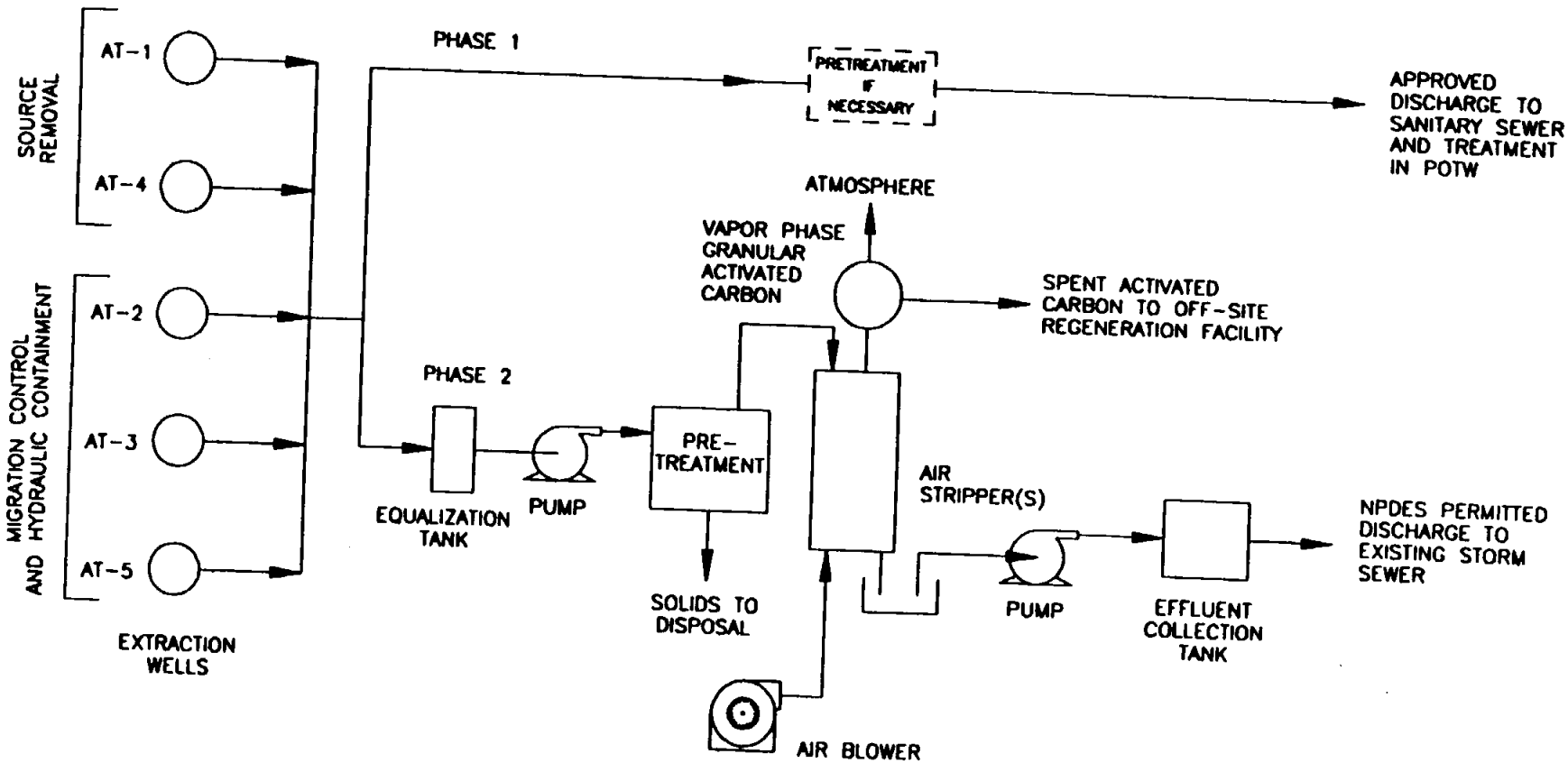
Phase II

- **Construction and operation of a ground water treatment system, with discharge of treated ground water through an NPDES-permitted outfall to the Mississippi River.** The unit operations for the treatment system as described in the FS include two-stage air stripping with treatment of the off-gas using granular activated carbon. The final unit operations will be determined during remedial design based on the discharge requirements established by the state during the NPDES submittal review process, and based on the results of treatability testing performed during Phase I.

- **Long-term monitoring of ground water quality changes and capture effectiveness.** A network of monitoring wells will be established and sampled to determine ground water quality changes during remediation and the effectiveness of ground water capture. Based on determinations of capture effectiveness, the pumping rates for individual wells will be adjusted as needed to optimize recovery. If necessary to achieve hydraulic control, additional wells will be installed.

Operations and Effectiveness Monitoring

The ground water recovery and treatment systems will be monitored for proper operation during the course of the remediation. This will include the following activities:



PREFERRED ALTERNATIVE: GROUND WATER PUMPOUT, TREATMENT AND DISPOSAL
PROCESS FLOW DIAGRAM

- Collection of combined flow water samples prior to discharge to the MWCC Pig's Eye Wastewater Treatment Facility.

- Hydraulic evaluation of the capture effectiveness of the recovery well network. The initial evaluation will occur within 90 days after start-up and will be submitted to the USEPA and the MPCA by the U.S. Navy.

- Periodic inspection of the ground water pumps, piping, and controls, and routine maintenance as required.

- Recording flow rates from individual wells and computing cumulative recovery volumes for payment of sewer use charges.

- Collection of individual well head samples for analysis of VOCs and other indicator constituents.

- Periodic inspection of pumps, blowers, piping, and other mechanical components of the treatment system, and routine maintenance as required.

- Collection and analysis of effluent samples from the ground water treatment plant to demonstrate compliance with approved discharge limits.

A ground water monitoring program will be implemented to determine the effectiveness of the remediation. This will include the following:

- Measurement of water levels in local monitoring wells to calculate the effective ground water capture zone. Additional wells will be added, if necessary.

- Adjustment of pumping rates as necessary to optimize ground water capture.

- Collection of ground water samples and analysis for VOCs and other indicator constituents.

- Calculation methods for determining if MCLs have been reached in the aquifer, and whether or not Alternative Concentration Limits (ACLs) are necessary.

A detailed operation, maintenance, and monitoring plan will be developed by the U.S. Navy during the remedial design phase. The plan will document specific operations and effectiveness monitoring techniques. The plan will be submitted for USEPA and MPCA review and approval prior to implementation.

During the first 90 days of recovery system operation, the Navy will collect data to determine whether hydraulic containment is being effectively achieved. This determination will be summarized in a document which will be sent to the USEPA and MPCA for review and

approval at the end of the 90-day period. The USEPA and MPCA will provide written approval of, or comments on, the determination document within 30 days after its receipt. If the USEPA and MPCA do not approve the determination document, the Navy will submit a revised determination document to the USEPA and MPCA within 60 days after the Navy is notified of specific deficiencies in the document. If the determination document, after its approval by the USEPA and MPCA, indicates that effective hydraulic containment is not being provided by the ground water recovery system, the Navy will prepare and submit to USEPA and MPCA a written plan for upgrading the recovery system to assure that the performance objectives of the containment system are met, and will implement the finally approved plan.

In addition, if it is determined by the Navy that pretreatment of water during the Phase I discharge is necessary to meet MWCC requirements, the Navy will submit an implementation plan to the USEPA and the MPCA within 30 days after this determination is made, which when approved by the USEPA and MPCA will be implemented by the Navy.

10. STATUTORY DETERMINATIONS

10.1 Protection of Human Health and the Environment

The selected remedy protects human health and the environment through hydraulic containment, recovery, and treatment of TCE-contaminated ground water. TCE and other VOCs will be permanently removed from the ground water by air-stripping or another appropriate treatment technology. Air emissions from this treatment will be set at protective levels established by the MPCA.

Recovery of the VOC-contaminated ground water will also eliminate the threat of exposure from ingestion of VOCs via ground water or surface water. The present potential carcinogenic risk of 2×10^{-5} to 2×10^{-6} will be reduced even further by hydraulically limiting the migration of TCE-contaminated ground water to the Mississippi River. The future potential carcinogenic risk of 3×10^{-3} to 3×10^{-4} will be reduced to a protective level based on the MCL for TCE, which will be the target cleanup level for the site (see discussion below).

There are no short-term threats associated with the selected remedy that would weigh against the long-term protection. No adverse cross media impacts are expected.

10.2 Compliance with ARARs

Chemical-Specific ARARs

Because of the potential for the placement of a supplemental well field in the contaminated ground water downgradient of the NIROP to provide additional drinking water to the city of Minneapolis, and questions regarding the permanence of existing prohibitions on placement of private wells in the parkland, federal and state health-based standards for drinking water were considered in determining the cleanup level required for the contaminated ground water aquifer. These include standards established under the Federal Safe Drinking Water Act (SDWA) and the State of Minnesota Recommended Allowable Limits (RALs) for drinking water.

The SDWA established Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) for specific contaminants to ensure the quality of drinking water supplies. MCLGs are non-enforceable health goals, set at levels where no known or anticipated adverse health effects will occur in exposed people and which allow for a margin of safety. Technical feasibility or cost are not taken into account. MCLs are enforceable limits for the concentration of certain contaminants in public water supplies. They are required to be at levels as close to MCLGs as feasible, taking into account use of the best available treatment technologies, costs to public water systems, and analytical limits of detection. The MCLG for TCE is 0. The promulgated MCL for TCE is 5.0 μg/L.

The MCLs and MCLGs apply at the tap to "public water systems," which are water systems having at least 15 service connections or which regularly serve at least 25 individuals. They would thus be applicable to water supplied to users of the Minneapolis public water supply. They would be applicable to ground water in the aquifers at the Anoka County Park if the aquifers were used directly for public drinking water. At this time, there are no wells downgradient of the NIROP supplying public drinking water. The Minneapolis water treatment plant intake receives some portion of the ground water, but this is diluted with river water, and the water is treated before delivery to users. The SDWA standards would apply after such dilution and treatment at the tap.

The SDWA standards are "relevant" cleanup standards for the remediated ground water, however, because the ground water may in the future be accessed through wells for a drinking water supply, and because it may be drawn into the Minneapolis public water supply intake in the Mississippi River downstream of the NIROP. The USEPA has determined that MCLs are relevant and appropriate standards for ground water that may be used for drinking water unless, under the circumstances at a site, more stringent standards must be applied to ensure protection of public health or the environment.

The Minnesota Department of Health's Recommended Allowable Limits (RALs) for drinking water may also be considered in establishing target ground water cleanup levels. Although these recommended contaminant levels are not promulgated state standards, and therefore are not ARARs, such nonpromulgated federal or state advisory levels may be considered in determining target cleanup levels. Similar to MCLs, these levels are in the 10^{-4} to 10^{-6} cancer risk range, which the USEPA has determined to be acceptable for carcinogens. The RAL for TCE is 31 µg/L. However, since the MCL is more protective, and since state guidance specifies that RALs should not be used in place of MCLs, the MCL for TCE (5 ppb) will serve as the target cleanup goal for ground water for the site.

Attainment of Cleanup Targets

The achievable concentration of any constituent in ground water from a pumping program cannot be predicted with certainty. At this site, there is a medium to high uncertainty that cleanup targets can be achieved within a reasonable time frame. Despite extensive recovery efforts, very low concentrations of TCE may persist in the aquifer above the target cleanup level. If at some time in the future, the Navy believes that achieving the target cleanup level (MCL) is technically impracticable, at that time the Navy will apply for an Alternate Concentration Limit (ACL) in accordance with guidance for implementation of ACLs. The Navy plans to use a mathematical formula to determine if concentrations have dropped to an asymptotic level. This asymptotic level will be used to show technical impracticability.

The procedures to be used to determine whether an asymptotic level has been reached, and when it has been reached, will be included in the ground water monitoring program plan to be submitted to the USEPA and the MPCA for review and approval prior to start-up of the ground water recovery system. In addition, if it is shown, based on the facts at the time, that upgradient sources are contributing VOCs to the ground water, the U.S. Navy

will request approval of an alternate cleanup target level or approval to terminate ground water recovery operations.

Action-Specific ARARs

The contaminated ground water extracted by pumping will be discharged under Phase I to the sanitary sewer for treatment at the Pig's Eye Wastewater Treatment Facility, a publicly owned treatment works (POTW). Section 307(b) of the Clean Water Act, 33 U.S.C. §1317(b), and regulations promulgated thereunder (40 CFR 403), require POTWs to develop and enforce pretreatment standards (specific effluent limitations regulating the amounts of pollutants that may be discharged to the POTW) to prevent interference with operation of the POTW and pass-through of pollutants through the wastewater treatment system to surface water. These requirements are applicable to this remedial action because, during Phase I, the contaminated ground water will be discharged to a POTW. The MWCC has established a discharge limit for total VOCs of 10 mg/L, and 3 mg/L for any single VOC to be met at the point of discharge to the existing sanitary sewer prior to mixing with any other wastewater. If necessary, pretreatment equipment will be installed to meet MWCC limits. During the discharge period, periodic monitoring will be conducted to demonstrate the effectiveness of hydraulic containment.

Under Phase II, the discharge of treated ground water to the Mississippi River will be subject to state NPDES requirements. The MPCA will set numerical limits for contaminant concentrations in the treated ground water. These limits will form the basis for final design of the ground water treatment plant at the NIROP.

Location-Specific ARARs

No location-specific ARARs have been identified.

Other Requirements

In addition to the regulations described above, the U.S. Navy will be responsible for obtaining all other federal, state, and local approvals which are necessary for performance of the ground water remedial action. The following requirements have been discussed with the USEPA and the MPCA for the remedial action at the NIROP:

- Minnesota Department of Health approval for all ground water recovery well installations.
- Minnesota Department of Natural Resources approval for ground water resource appropriation.
- Minnesota Pollution Control Agency agreement with respect to the state nondegradation policy for surface water discharges.
- Minnesota Pollution Control Agency approval for a point-source air discharge from the air stripping columns in the ground water treatment facility.
- Metropolitan Waste Control Commission, Anoka County, and City of Fridley approvals for access to and construction of sewer tie-ins as needed.

The U.S. Navy has also obtained approval from FMC for placement of recovery and monitoring wells on FMC property.

The MPCA, MWCC, Anoka County, and the City of Fridley have been active in TRC meetings and are aware of the proposed remedial action. This prior knowledge and participation in project planning should facilitate the approval process.

10.3 Cost-Effectiveness

The selected remedy is cost effective because it provides a degree of protection commensurate with its cost. The present-worth cost estimate for the selected alternative (Alternative F) is $3,700,000. Of the two alternatives providing direct ground water recovery (Alternatives E and F), the selected remedy is the less costly.

10.4 Utilization of Permanent Solutions and Alternative Treatment Technologies

The selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner. Treatment is a principal element of the remedy as it will be applied to the recovered ground water. The remedy is permanent because it results in removal of TCE and other constituents from the aquifer.

The remedy represents the best balance among the nine criteria used in the alternatives evaluation. Of the available alternatives evaluated, it provides the highest degree of protection in reducing potential present and future exposure to TCE. The remedy will comply with ARARs by meeting the MCL for TCE as the target cleanup level for the site. The alternative will reduce the toxicity, mobility, and volume of TCE in the aquifer. By meeting the MCL for TCE, other VOCs will also be reduced proportionately. The alternative is implementable and is effective in both the short-term and long-term. The MPCA and the USEPA concur with the remedy.

10.5 Preference for Treatment as a Principal Element

Ground water will be treated during the initial Phase I period at the Pig's Eye Wastewater Treatment Plant and during the long-term Phase II period at a treatment plant at the NIROP specifically designed and constructed for that purpose. Therefore, the statutory preference for remedies that employ treatment as a principal element is satisfied.

RESPONSIVENESS SUMMARY

OVERVIEW

At the time of the public comment period, the U.S. Navy had selected a preferred remedy to address ground water contamination at the NIROP. This preferred remedy was selected in coordination with the USEPA and the MPCA. Other members of the Technical Review Committee (TRC) for this project were also involved in discussions and planning of the ground water recovery and treatment alternative. Technical details of the alternative have been discussed, and no fundamental objections to its selection have been raised.

The sections below describe the background of community involvement on the project and the U.S. Navy's responses to verbal and written comments received during the public comment period.

BACKGROUND OF COMMUNITY INVOLVEMENT

Prior to the public comment period in May 1990, there was limited community involvement in activities at the NIROP. In May 1989, newspaper announcements were placed for a public meeting presented by the U.S. Navy in Fridley to discuss the results of the RI/FS. There was no attendance at this meeting.

Local input to the selection of the preferred remedy has come predominantly through the TRC, established by the U.S. Navy. Meetings held approximately quarterly since early 1989 have brought together local representatives of the water and wastewater utilities, and the city and county. This involvement has facilitated remedial planning by the U.S. Navy and has alerted affected local groups to the proposed activities.

SUMMARY OF COMMENTS RECEIVED DURING PUBLIC COMMENT PERIOD

During the public comment period, two letters were received. At the public meeting on May 9, 1990, several questions and comments were raised.

The written and verbal comments can be divided into two broad categories: those related to the protectiveness of the preferred remedy and those related to effects on the local and regional aquifer system. Specific comments are addressed below:

Protectiveness of the Preferred Remedy

1. Comment (verbal): Is the activity at NIROP related to that at FMC?

   Response: The ground water cleanup planned for the NIROP is distinct from that at FMC. Although the contamination and remedies at the two locations have similarities, the projects are implemented, managed, and monitored separately.

2. Comment (verbal): The "no-action" alternative is not a reasonable alternative.

   Response: The U.S. Navy agrees.

3. Comment (verbal): Do VOCs pose a fire potential?

   Response: In concentrated form, VOCs may pose a flammable or explosive hazard. In dilute concentrations in ground water, such as would be recovered from the NIROP, no such hazard would exist.

4. Comment (verbal): Since TCE is heavier than water, how does it migrate into the Mississippi River?

   Response: In its pure form, TCE is heavier than water and would tend to settle to the bottom of an aquifer. However, when it is dissolved in water at relatively low concentrations such as found at the NIROP, it is free to migrate along with ground water flow. Ground water at the NIROP enters the Mississippi River and carries dissolved TCE with it.

5. Comment (verbal): During a flood event, could the ground water pumpout and discharge system be shut down to avoid additional flow in the river?

   Response: Yes. Although it is desirable to maintain continuous operation over a long period of time, the system can be shut off, as needed, under any emergency situation. The ground water discharge would also be very small in comparison to the river flow.

6. Comment (verbal): Is there a potential for leakage from the sewers which receive ground water from the pumpout system?

Response: Sewers are typically not completely watertight. The NIROP intends to temporarily discharge untreated ground water into a 96-inch-diameter sanitary interceptor sewer. Ground water will be diluted with industrial and municipal wastewater flowing into the sewer. The effect of ground water on the overall quality of wastewater in the sewer is expected to be negligible. If leaks occurred, the effect of contaminants from the temporary contribution of NIROP ground water versus contaminants contributed from the other wastewater sources would not be significant.

7. Comment (verbal): Does the Pig's Eye Wastewater Treatment Plant have the capacity to accept the volume of water from the NIROP?

Response: Approval for the ground water discharge will be obtained from the Metropolitan Waste Control Commission (MWCC). In initial discussions, the MWCC has not indicated that the expected flow from the NIROP will be a problem.

8. Comment (verbal): The Pig's Eye Plant is a secondary treatment plant which is not equipped to remove chemicals from the wastewater.

Response: It is true that the Pig's Eye Plant does not provide a tertiary level of treatment specifically for synthetic chemicals. However, the aeration and biological treatment provided by the plant will serve to reduce volatile organics, such as TCE. Also, the quality of the plant's treated water discharge is established by a state permit which is based on protection of the receiving water body.

9. Comment (verbal): What will the quality of water be after on-site treatment?

Response: The quality of treated ground water will be set by the MPCA for discharge to the Mississippi River. The allowable limits will be based on protection of the river environment and downstream users.

10. Comment (verbal): Will packed tower aeration be considered as a treatment technology? Can the water be treated by distillation?

Response: Packed tower aeration (air stripping) will likely be part of the treatment process. Other options, either singly or in combination with air stripping, will be reviewed during final system design to determine the best way to meet the ground water treatment objectives. Distillation is appropriate to recover solvents such as TCE from concentrated liquids, but not from the dilute concentrations found in the ground water.

11. Comment (verbal): Chlorine gas would be produced from regeneration of activated carbon used to treat the ground water.

Response: Activated carbon, if used for ground water treatment at the NIROP, would be regenerated at an off-site facility designed to perform that function. Air emissions from the regeneration process would be regulated by state air permits, which would establish emission limits protective of the local area.

Effects on the Local Ground Water Resource

12. Comment (verbal): What is the origin of ground water beneath the NIROP?

Response: Ground water beneath the NIROP originates as rain and snowmelt that infiltrates through the soil to the aquifer. The area over which this infiltration takes place extends to the north and east of the NIROP.

13. Comment (written): What effect will the pumpout system have on shallow, private wells in the area?

Response: No shallow, private wells have been identified in the immediate vicinity of the NIROP. The calculations completed for the radius of influence of the capture wells indicate that the off-site effect of the pumping will extend only into the Anoka County Park, west of the NIROP.

14. Comment (written): What effect will pumping have on the moisture content of clay layers (and subsequent strength relative to settlement) beneath the Horizon Circle and Crown Road area?

Response: The pumpout system will not affect the hydraulic head in the vicinity of Horizon Circle and Crown Road. The calculation of the radius of influence indicates that the effect of the pumping will be limited to the immediate vicinity of the pumpout system wells.

15. Comment (verbal): The City of Fridley draws water from the Prairie du Chien formation where water levels have been dropping. Will the pumpout system deplete the amount of water in the aquifer available to communities?

Response: The pumpout system will not deplete the amount of water available to local communities. The pumpout system will be constructed in an aquifer that overlies the Prairie du Chien formation. The hydrogeologic data obtained during the RI indicate that there is little interconnection between the Prairie du Chien and the overlying aquifer in the vicinity of the NIROP.

16. Comment (verbal): To alleviate demand on city supplies, can pumped ground water be used beneficially as cooling water in the plant?

Response: FMC considered this option when designing their ground water pumpout program, but found it to be infeasible from an engineering perspective. However, the U.S. Navy will consider this option during final design of its system to determine if it is viable.

17. Comment (written): The water should be cleaned and used in Fridley.

Response: The U.S. Navy agrees that the water resource should not be wasted. It will consider options for beneficial re-use if plans or proposals are developed and forwarded by the City or others.

18. Comment (written): Will the discharge to the MWCC be metered so that Fridley will not be charged for the water usage?

Response: Yes. The U.S. Navy will pay the MWCC for discharges from its system.

19. Comment (verbal): Will the diversion of this amount of ground water, which currently enters the river, cause more severe problems with low river flow if the recent drought conditions were to continue?

Response: The ground water will only be diverted from eventual discharge into the river during the Phase I pumpout period, when the ground water will be discharged to the local sanitary sewer. Phase I is planned to last no more than 3 years. When the on-site ground water treatment system is started up under Phase II, the treated ground water will be discharged to the river near the NIROP, thus maintaining the same ground water flow to the river as under present conditions. The slightly reduced river flow resulting from ground water discharge of up to 650 gallons per minute to the sanitary sewer during Phase I is not expected to have an adverse impact during potential drought conditions, due to the substantial volume of river flow compared to the volume of pumped ground water flow even under the drought conditions. (For example, even during the drought period of 1988, the lowest river flow was approximately 400,000 gallons per minute.)